VIBRATION REDUCING DEVICE FOR ARCHERY BOWS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation-in-part of United States Patent Application Serial No. 09/864,103, filed May 23, 2001, which claims priority to United States Provisional Patent Application Serial No. 60/206,250, filed May 23, 2000, the contents of which are incorporated by reference in their entirety herein.

BACKGROUND OF THE INVENTION

[0002] When firing an arrow from a bow, an archer positions the shaft of an arrow on a bow grip such that the nock of the arrow engages the bow string. Thereafter, the archer draws the arrow and bow string rearwardly from the limbs of the bow and the bow grip. As a result, great forces are built up and stored in the deflection of the bow limbs as the bow string is retracted. To cast the arrow, the archer releases the bow string thereby permitting the bow limbs to rapidly return to a resting position and resulting in the arrow being cast from the bow.

[0003] Frequently, as the arrow is released from the bow and immediately thereafter, an extreme vibration is generated in various parts of the bow. In addition, some archers torque the bow off the target line when casting the arrow. The torque and resulting bow movement may also be produced by a physical reactive effect known as "archer's paradox." The various vibrations and torques created when casting an arrow rob the arrow of energy and may negatively affect the accuracy and speed of the arrow during flight. Furthermore, the vibrations and torques over time may shorten the life of the bow and the various bow components. Lastly, the vibrations and torques created when casting an arrow may result in physical discomfort to the archer and may adversely affect the joints of the archer over a period of time.

[0004] Thus, in view of the foregoing, there is an ongoing need for a vibration-reducing device for archery bows.

BRIEF SUMMARY OF THE INVENTION

[0005] The present application discloses various embodiments of vibration dampening devices for archery bows.

[0006] In one embodiment, a dampening device for a bow is disclosed and includes a body portion, a substantially wedge-like extension extending from the body portion, and a planar surface connected to the body portion and configured to be secured to a bow.

[0007] In yet another embodiment, a dampening device is disclosed and includes a body portion, a substantially wedge-like extension extending from the body portion, a planar surface connected to the body portion and configured to be secured to a bow, and an attachment plate coupled to the body portion.

[0008] In still another embodiment, a dampening device for a bow is disclosed and includes at least one anchoring device configured to be affixed to the bow, and a body portion having a substantially wedge-like extension extending from the body portion and a planar surface connected to the body portion. The body portion is configured to couple to the anchoring device.

[0009] Other objects, features, and advantages of the present invention will become apparent from a consideration of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The dampening device of the present application will be explained in more detail by way of the accompanying drawings, wherein:

[0011] FIG. 1 shows a side view of a bow having an embodiment of a dampening device attached thereto proximate to the bow pulleys of the bow;

[0012] FIG. 2 shows a front view of a bow having an embodiment of a dampening device attached thereto proximate to the bow pulleys of the bow;

[0013] FIG. 3 shows a side view of a first bow limb of a bow having an embodiment of a dampening device attached thereto;

[0014] FIG. 4 shows a side view of a bow having an embodiment of a dampening device attached thereto proximate to the bow riser of the bow;

[0015] FIG. 5 shows a front view of a bow having an embodiment of a dampening device attached thereto proximate to the bow riser of the bow;

[0016] FIG. 6 shows a side view of an embodiment of a dampening device;

[0017] FIG. 7 shows a rear view of an embodiment of a dampening device having a base plate attached to a planar surface of the body portion as viewed along on the lines 7-7 of FIG. 6;

[0018] FIG. 8 shows a top view of an embodiment of a dampening device as viewed along on the lines 8-8 of FIG. 6;

[0019] FIG. 9 shows an elevated side view of an embodiment of a dampening device having an attachment slot formed in an attachment plate;

[0020] FIG. 10 shows a top view of an attachment plate device which may be affixed to a body portion of a dampening device;

[0021] FIG. 11 shows an elevated view of another embodiment of a dampening device having an attachment member integral with the body portion;

[0022] FIG. 12 shows a side cross-sectional view of an embodiment of an attachment device integral with a body portion of the dampening device shown in FIG. 11;

[0023] FIG. 13 shows a side cross-sectional view of an embodiment of an attachment device integral with a body portion of the dampening device shown in FIG. 11 attached to a bow;

[0024] FIG. 14 shows a cross-sectional view of an alternate embodiment of an attachment member for coupling a dampening device to a bow;

[0025] FIG. 15 shows an elevated side view of an embodiment of a dampening device having an attachment passage formed in the body portion;

[0026] FIG. 16 shows an elevated side view of an embodiment of an anchoring device of an embodiment of a dampening device;

[0027] FIG. 17 shows an elevated side view of an embodiment of a body portion of a dampening device;

[0028] FIG. 18 shows an embodiment of a dampening device having an anchoring device coupled to a bow and having a body portion coupled to the anchoring device;

[0029] FIG. 19 shows an embodiment of a dampening device having an anchoring device coupled to a bow;

[0030] FIG. 20 shows an elevated side view of an alternate embodiment of an anchoring device for use in anchoring an embodiment of the body portion of the dampening device as illustrated in FIG. 17 to a bow;

[0031] FIG. 21 shows an elevated side view of an embodiment of an insert for use with the anchoring device as illustrated in FIG. 20;

[0032] FIG. 22 shows an elevated side view of an embodiment of an insert being inserted into the anchoring device as illustrated in FIG. 20;

[0033] FIG. 23 shows an elevated side view of an embodiment of a dampening device having an anchoring device as shown in FIG. 22 attached to the bow;

[0034] FIG. 24 shows an elevated side view of an embodiment of a dampening device having an anchoring device as shown in FIG. 22 attached to the bow wherein an insert is being positioned within the anchoring device;

[0035] FIG. 25 shows an elevated side view of an alternate embodiment of a body portion of a dampening device having an insert formed therein;

[0036] FIG. 26 shows an elevated side view of another embodiment of a body portion of a dampening device having an insert formed therein; and

[0037] FIG. 27 shows a side view of a test rig used to test the vibration characteristics of a bow.

DETAILED DESCRIPTION OF THE INVENTION

[0038] FIG. 1 shows an embodiment of a bow 1 having bow limbs 3A, 3B coupled to a bow riser 4 having a bow grip 5 attached thereto. As shown in FIG. 1, a bow string 7 is engaging bow pulleys 9A, 9B located on the bow limbs 3A, 3B. A dampening device 10 is attached to the bow limbs 3A, 3B. As shown, a first dampening device 10 is positioned on the first bow limb 3A and a second dampening device 10 is positioned on the second bow limb 3B. Those skilled in the art will appreciate any number of dampening devices 10 may be positioned on the first bow limb 3A, the second bow limb 3B, or both. For example, FIG. 2 shows an embodiment wherein a bow 1 includes two dampening devices 10 positioned on the first bow limb 3A, and two dampening devices 10 on the second bow limb 3B. Optionally, an equal number or unequal number of dampening devices may be position on the bow limbs 3A, 3B. As shown in FIGS. 1 and 2, the dampening devices 10 may be positioned on a first surface 11A of the bows limbs 3A, 3B. Optionally, at least one dampening device 10 may be positioned on a second surface 11B of the bow limbs 3A, 3B. In an alternate embodiment, either the first or second bow limb 3A, 3B, respectively may not include a dampening device 10 thereon.

[0039] In the embodiments illustrated in FIGS. 1-3, the dampening devices 10 are positioned proximate to the bow pulleys 9A, 9B. Optionally, the dampening devices 10 may be positioned anywhere along the length of the bow limbs 3A, 3B, the bow riser 4, and/or the bow grip 5. As shown in FIGS. 4 and 5, the dampening devices 10 may be positioned proximate to the bow riser 4. For example, the dampening device 10 may include an attachment port (not shown) configured to receive a fastening device (not shown) therethrough. In the alternative, the dampening devices 10

may be positioned on the bow limbs 3A, 3B intermediate of the bow pulleys 9A, 9B and the bow riser 4. Those skilled in the art will appreciate that by repositioning the dampening device 10 along the bow limbs 3A, 3B, the archer may tailor the dampening effects of the dampening device 10 and the bow 1 to his or her liking. In one embodiment, the dampening device 10 is manufactured from an elastomer. Optionally, the dampening device 10 may be manufactured from a variety of materials, including, without limitation, elastomers, silicons, rubbers, plastics, fiberglasses, carbon fibers, composite materials, metals, ceramics, or any other suitable materials having appropriate dampening characteristics. For example, in one embodiment, the dampening device 10 may be manufactured from a material, such as fiberglass, and may be frequency matched to the vibrational frequency of the bow 1 or the various components thereof.

[0040] FIGS. 6-8 show various views of an embodiment of a dampening device 10. As shown, the dampening device 10 includes a body portion 12 and a wedge-like extension 14 extending from the body portion 12. The wedge-like extension 14 includes a substantially triangular shape tapering away from the body portion 12. A planar surface 16 is provided integral to or otherwise connected to the body portion 12. In the illustrated embodiment the planar surface 16 includes an adhesive face A, which may be overlaid with a protective liner (not shown) for storage and transport, thereby permitting the dampening device 10 to be adhesively coupled to the bow limbs 3A, 3B or the bow 1. (See FIG.1). In an alternate embodiment, a base plate (not shown) may be coupled to the planar surface 16. For example, the base plate (not shown) may be adhesively coupled to the planar surface 16, although a variety of materials may be used to coupled the base plate (not shown) to the planar surface 16. A variety of adhesives can be used for affixing each dampening device 10 to a bow 1, including super glue, general purpose glue, epoxy resin, acrylic resin, urethane, resin, cement, natural gums and resins, mucilage, starch and starch derivatives, rubber adhesives, cellulose derivatives, or combinations thereof. In lieu of adhesive fastening, a variety of mechanical fasteners can be used to couple the dampening device 10 to the bow, including, without limitation, screws, nails, clips, channels, bands, ties, compression fits, snap-fits, and the like.

[0041] FIGS. 9 and 10 show another embodiment of a dampening device 110. As shown, the dampening device 110 includes a body portion 112 coupled to an attachment plate 116. The body

portion 112 includes a planar surface 113 and a wedge-like extension 114 extending from the body portion 112. The attachment plate 116 includes at least one attachment port or slot 120 formed thereon. The attachment slot 120 may traverse the attachment plate 116 and body portion 112 and may be configured to receive one or more attachment devices 122 therein. In the illustrated embodiment, the attachment slot 120 is located distally from the wedge-like extension 114. In an alternate embodiment, the attachment slot 120 may be positioned proximate to the wedge-like extension 114. In the illustrated embodiment the attachment device 122 is shown to be a screw. However, any number of devices may be inserted into the attachment slot 120 to couple the dampening device 110 to a bow 1, (see FIG. 1), including, bolts, pins, screws, nails, or similar devices. In one embodiment, the dampening device 110 may be coupled to the bow limbs 3A, 3B with bow limb fasteners used for coupling the bow limbs 3A, 3B to the bow riser 4. For example, the user may loosen a bow limb fastener from the bow limb 3A and position the dampening device 110 such that the bow limb fastener traverses the attachment device slot 120. Thereafter, the user may re-tighten the bow limb fastener thereby coupling the dampeneing device 110 to the bow 1. As such, FIGS. 4 and 5 show an embodiment of a dampening device 10 attached to the bow limbs 3A, 3B of a bow 1 proximate to the bow riser 4 using attachment devices 122.

[0042] FIGS. 11-14 show an alternate embodiment of a dampening device. As shown in FIGS. 11-13, the dampening device 210 includes a body portion 212 and an attachment plate 216. At least one attachment member 224 may be attached to or integral to either the body portion 212, the attachment plate 216, or both. The attachment member 224 is configured to engage and be retained within an attachment orifice 230 formed in a bow limb 3A or 3B, or the bow riser 4 (See FIG. 1). In one embodiment, the attachment member 224 may include a head portion 226 having a first diameter D connected to the body portion 212 through a shaft 228. The shaft 228 has a diameter D' which is less than the diameter D of the head portion 226. When inserted into the attachment orifice 230, the head portion 226 is compressed and made to traverse a section of the bow limb 3A through the attachment orifice 230, thereby coupling the dampening device 210 to the bow limb 3A. FIG. 14 shows an alternate embodiment of an attachment member 250 having a shaft 258 having one or more flexible flanges 260 extending therefrom. The flanges 260 are configured to be inserted into an attachment orifice 230 and retained therein. Those skilled in the art will appreciate that the

attachment member 250 is configured to engage any thickness of a bow limb 3A or be otherwise coupled to a bow 1, thereby permitting a single dampening device 210 to be coupled to a variety of bow styles or bow manufactured by a variety of bow manufacturers. In addition, the attachment member 224 illustrated in FIG. 14 permits a user to vary the depth the attachment member 224 is inserted into the attachment orifice 230 thereby permitting the user to tailor the dampening qualities of the dampening device 210 to his or her liking.

[0043] FIG. 15 shows another embodiment of a dampening device 310 wherein the body portion 312 includes at least one attachment passageway 332 formed therein. The attachment passageway 332 may be formed on the body portion 312 proximate to the planar surface 313. In an alternate embodiment, the attachment passageway 332 may located distally from the planar surface 313. The attachment passageway 332 may be configured to receive one or more attachment ties 334 therethrough. Exemplary attachment ties 334 include, without limitation, strings, bands, cables, ties, zip ties, tapes, ropes, clamps, or the like. In the illustrated embodiment, the dampening device 310 is coupled to the bow limb 3A. Optionally, the dampening device 310 may be coupled to any portion of the bow 1 (See FIG. 1) including, the bow limbs 3A, 3B, the bow riser 4, and/or the bow grip 5. As a result, those skilled in the art will appreciate that dampening device 310 may be coupled to the bow 1 without modifying the bow limb 3A or forming a hole therein.

[0044] FIGS. 16-19 illustrate another embodiment of a dampening device 410. As shown, the dampening device 410 may include an anchoring device 440 attachable to bow limbs 3A, 3B. (See FIG. 1) and a body portion 412' configured to be detachably coupled to the anchoring device 440. Referring to FIG. 16, the anchoring device 440 may be detachably coupled to the bow 1 and includes an anchor body 442 defining a bow limb passage 444 and having at least one coupling channel 446 formed thereon. The bow limb passage 444 is size to engage and be retained on at least one of the bow limbs 3A, 3B of the bow 1. (See FIG. 1). In the illustrated embodiment, the bow limb passage 444 is sized to receive the first and second bow limbs 3A, 3B, respectively, therein and may compressively attach thereto. Optionally, anchoring device 440 may couple to the bow limbs 3A, 3B using a variety of ways. For example, the anchoring device 440 may include adhesive, screws, bolts, pins, ties, or other device to attach the anchoring device 440 to the bow limbs 3A, 3B. In the

illustrated embodiment, two coupling channels 446A, 446B are formed on the anchoring device 440. Optionally, any number of coupling channels may be formed on the body portion 412'. As shown in FIGS. 18 and 19, the dampening device 410 is positioned on the second surface 11B of the bow limbs 3A proximate to the bow pulley 9A. Those skilled in the art will appreciate that the dampening device 410 may be coupled to the bow 1 at any variety of locations and surfaces.

[0045] Referring to FIGS. 16 and 17, the body portion 412' includes a wedge-like extension 414' extending therefrom and a planar surface 413' attached thereto. In one embodiment, the planar surface 413' extends beyond the width W of the body portion 412' and is configured to engage and be retained within the coupling channel 446. Exemplary devices used to couple the body portion 412' to the anchoring device 440 include, without limitation, lock members, lock channels, screws, pins, friction fits, snap fits, adhesives, and tapes.

[0046] FIGS. 18 and 19 show an embodiment of the anchoring element 440 and the anchoring elements coupled to the first bow limb 3A. As shown in FIG. 18, the anchoring elements 440 are coupled to the bow limb 3A proximate to a bow pulley relief 450 and the body portion 412' is detachably coupled to the anchoring device 440. In FIG. 19, the body portion 412' has been removed from the bow limb 3A leaving the anchoring element 440 attached thereto.

[0047] FIGS. 20-24 show an alternate embodiment of an anchoring device 560. As shown in FIGS. 20-22, the anchoring device 560 includes an anchor body 562 defining an insert passage 564 and at least one bow limb passage 566 therein. The insert passage 564 is sized to receive an insert 580 therein. In one embodiment, the insert 580 is manufactured from the material used to manufacture the anchoring device 562. In an alternate embodiment, the insert 580 may be manufactured from a different material used to manufacture the anchoring device 562. For example, the insert 580 may be manufactured from fiberglass, metals, composite materials, plastics, silicons, rubbers, ceramics, or any other material having suitable dampening characteristics. In one embodiment, the insert 580 is manufactured from a material which is frequency matched to the vibrational frequency of the bow 1 of the various components thereof. The insert 580 and the insert passage 562 may be manufactured in a variety of shapes, including rectangular, square, circular, and

oval. The bow limb passage 566 are sized to receive and retain at least a portion of the bow limbs 3A, 3B therein. FIG. 22 shows the insert 580 being inserted into the anchoring device 560. The insert 580 may be inserted into the insert passage 562 and advanced therein along the line of arrow A. Those skilled in the art will appreciate the ability of the user to remove and replace the insert 580 within the insert passage 560 permits the user to tailor the dampening qualities and "feel" of the dampening device and bow to his or her liking. In an alternate embodiment, the insert 580 may be partially inserted into the insert passage 560 thereby permitting the user to "tune" the dampening qualities of the dampening device. For example, the user may partially install the insert 580 in the insert passage 560 to match the vibrational frequency of the dampening device 410 to the vibrational characteristics of the bow 1.

[0048] FIGS. 23 and 24 show the anchoring device 560 attached to the first bow limb 3A. As shown, a body portion 512' may be detachably coupled to the anchoring element 560 as described above. In the embodiment shown in FIG. 23, the insert passage 564 is free of an insert 580. If desired, the user may utilize the anchoring elements 560 and body portion 512' without inserting an insert 580 therein. Alternatively, the user may choose to install the insert 580 into the insert passage 564, as shown in FIG. 24, by inserting the insert 580 into the insert passage 564 and advancing the insert 580 along arrow A.

[0049] FIGS. 25 and 26 show alternate embodiments of dampening devices. As shown in FIG. 25, the dampening device 610 includes an insert 616 formed in a wedge-like portion 614. The dampening device 610 consists of at least two parts made of a vibration dampening material, such as an elastomer. In one embodiment, the two parts are made of the same vibration dampening material. In an alternate embodiment, the two parts are made of vibration dampening materials having different hardness and dampening properties. In one embodiment, the planar surface 613 has a shortened length and may be adhered or otherwise coupled to the bow 1. As shown, an adhesive A may be used to couple the dampening device 610 to the bow, although an6y number of fasteners may be used to couple the dampening device 610 to the bow 1. The wedge-like extension 614 includes an insert 616 suspended above the bow limb 3A, 3B. (See FIG. 1). In one embodiment, the planar surface 613 comprises a flexible plastic plate attached the body portion 612. FIG. 26 shows

an embodiment of the dampening device 710 having an insert 716 formed in the body portion 712 proximate to the wedge-like extension 714. Unlike the embodiment shown in FIG. 25, the planar surface 713 is in communication with or positioned proximate to the wedge-like extension 714. The planar surface 713 may include an adhesive A for affixing the dampening device 710 to the bow, or may include any number of attaching device thereon.

[0050] The various embodiments of the dampening devices disclosed above may be manufactured in a variety of sizes and shapes. For example, as shown in FIGS. 6-8, the body portion 12 may be manufactured to form a continuous structure. In the alternative, the body portion 12 may include one or more irregularities formed thereon. As shown in FIG. 10, the body portion 12 may include one or more slots 90 formed thereon. Optionally, the body portion 12 may include one or more bumps, holes, tabs, fins, fenestrations, or other surface irregularity thereon. Further, the dampening devices disclosed herein may be manufactured form one or more elastomers. For example, the dampening device may be manufactured from an elastomer having a Shore hardness of 0-60 (Shore A scale). In the alternative, multiple elastomers may be used having a combination of different Shore hardness of the elastomers can range from 0-60 (Shore A scale). Optionally, the dampening device may be manufactured from fiberglass, metals, ceramics, plastics, composite materials, or any other material having a desired dampening or vibrational characteristics. In one embodiment the dampening device is approximately 65mm long by 15mm wide and 25mm high, but dimensions can vary depending on the size and power of the bows and cross bows.

[0051] In the various embodiments disclosed above, the dampening devices or components thereof may be attached to the bow at various locations. For example, the dampening device may be coupled to the bow limbs, bow riser, or bow grip. After the arrow is released, the limbs generate intense vibration. By oscillating independently from the limbs, the dampening device speedily and effectively dampens the vibration of the limbs and reduces the noise associated with it.

[0052] FIG. 27 shows a test rig used in MIT's Harold Edgerton laboratory to evaluate the dampener of the invention and U.S. 5,362,046 of November 8, 1994 (S.C. Sims). Amplitude and frequency of oscillation (and acceleration) of the bow were measured without dampeners and with

respective dampeners attached. Those tests were supplemented by stroboscopic photography. Similar tests were made with a hand held bow. Both forms of dampeners significantly reduced vibration of the bow. Also the present invention had noticeable improvement over the dampener of the '046 patent in reduction of amplitude of the acceleration waveform for bow vibration, particularly in a 40-60 millisecond time range (after string release).

[0053] Although the invention has been described with respect to various embodiments, it should be realized this invention is also capable of a wide variety of further and other embodiments within the spirit and scope of the appended claims.